European Commission

The EOPEN Pilot Use Cases

Presenters:
Gabriella Scarpino, Serco Italia (Deputy Project Coordinator)
Stelios Andreadis, CERTH (Technical Team)

Use Case Leaders:
UC1 - Francesco Zaffanella, AAWA
UC2 - Vasileios Sitokonstantinou, NOA
UC3 – Jani Tyynelä, FMI

EOPEN Side Event for ESA EO Φ-WEEK 2020 - 28 September - 02 October 2020

EOPEN – Framework for delivering interoperable digital services

The EOPEN Pilot Use Cases (PUCs)

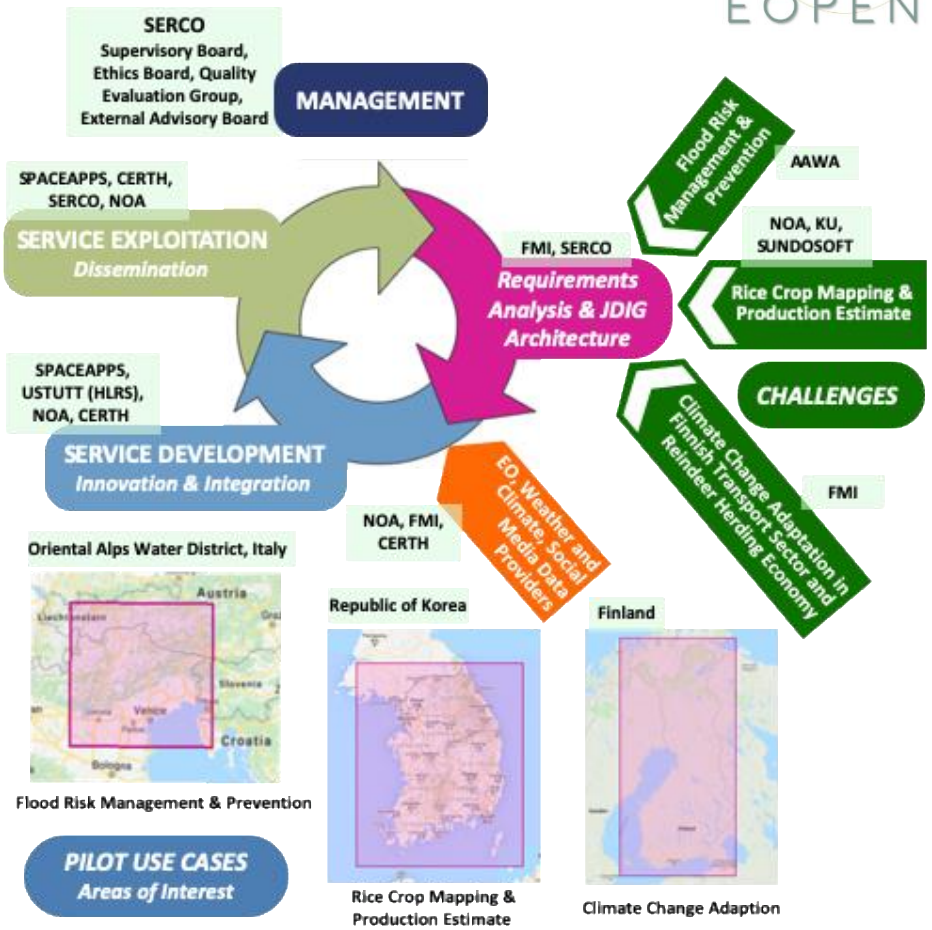
Overview

- EOPEN Use Case challenges - Application-Service full life cycle support
- JDIG Architecture
- Providing Weather and Climate Data for Use Cases
- Sentinel 1-2 data use in PUC1 and PUC2
- Social media data use in all Use Cases
- Combining EO and non-EO data in PUC1
- Pilot Use Case 1 – Flood Risk Assessment and Prevention
- Pilot Use Case 2 – Food Security
- Pilot Use Case 3 – Climate Change

Application-Service full life cycle support

The EOPEN lifecycle model is used to develop services and has been used to implement 3 pilot use cases

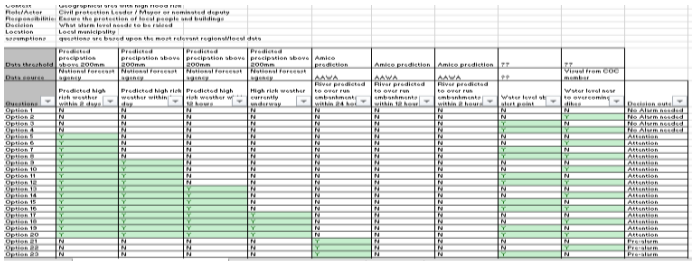
1. Flood prevention;
2. Food security;
3. Climate Change.

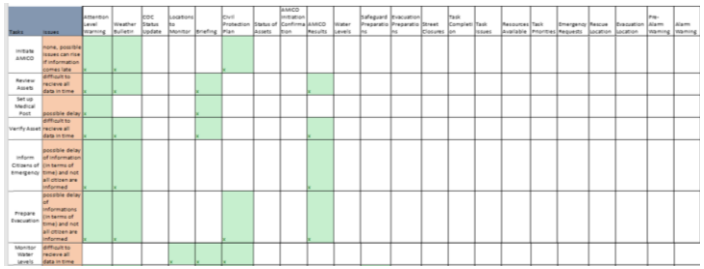


EOPEN

JDIG Architecture

Stakeholder	Reindeer Herders	Reindeer Herders	Reindeer Herders	Reindeer Herders	FTIA	FTIA	FTIA	FTIA	Reindeer Researchers	Reindeer Researchers
Type of data obtained	Weather Forecast	Snow Amount Observations	Knowhow/ Experience	Long Timeseries	Weather Forecast	Snow Accumulation	Temperature/ Snowfall: 10-year trends	Climate Models	Temperature/ Snowfall: 10-year trends	Climate Models
Frequency of collection	Daily / more frequently in severe weather	Infrequent	Infrequent	After severe weather event	Daily	Daily	Yearly	Yearly	AD Hoc, Yearly	AD Hoc, Yearly





	Stakeholders			
Data types	R_Herders	R_Researchers	FTA	
Data Collection				
Historical Snow data				
Current Snow data				
Predicted Snow data				
Historical Climate data				
Current Climate data				
Predicted Climate data				
Data Analytics				
Historical Impact of snow/climate on reindeers				
Historical Impact of snow/climate on road network				
Predicted Impact of snow/climate on reindeers				
Predicted Impact of snow/climate on road network				
Severe weather event probability				
Severe weather event exceptions				

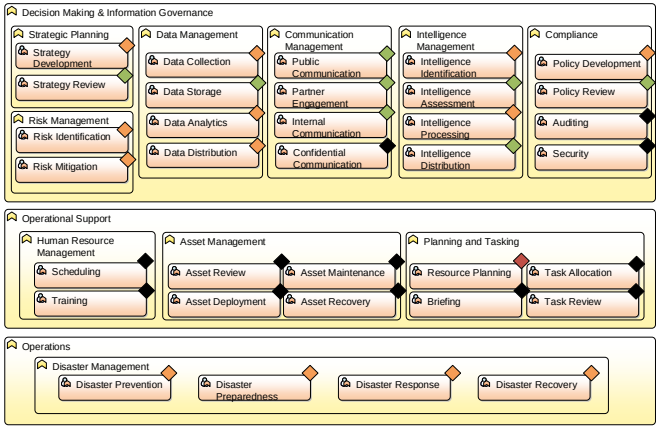
Key	Description	Scoring
	Satisfactory data	3
	Improvement needed	2
	No data or innaccurate	1
	Not Applicable	n/a

Data Capability assessment	
1 -1.5	Red
1.51 -2.5	Amber
2.51 -3	Green

Data Capability Assessment				Total
Data Collection	1.5	2.16	2.16	1.94
Data Analytics	1.5	2	1.75	1.75

Data Capability Assessment

PUC2: COM Holistic Capability Assessment



Holistic Capability Assessment

JDIG (Joint Decision & Information Governance Architecture) was used in combination with traditional requirements gathering to perform robust analysis of the current and target operating models.

Providing Weather and Climate Data for Use Cases

Open Data, Multiple Providers

FMI DATA

smos

Climate Change Service

POWER
Prediction Of Worldwide Energy Resources

GLOBSNOW

Data preparation

Get data via customised connectors

Convert data to unified data format

Store data in EOPEN Platform

Use Cases

Flood Monitoring

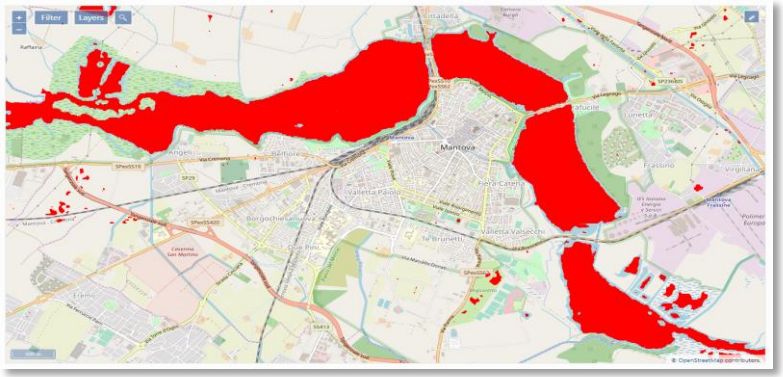
- Precipitation Forecasts

Climate Change

- Weather Observations
- Climatology
- Level 3 EO Products
- Reanalysis model data

Sentinel-1 and Sentinel-2 data use in PUC1 and PUC2

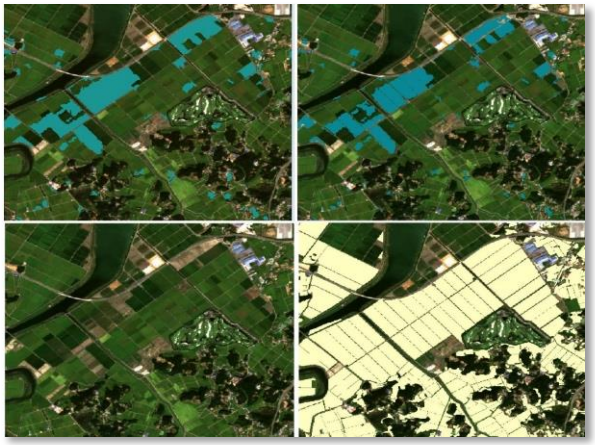
Deep Convolutional Neural Network (DCNN) for remote sensing classification in order to identify water areas in a S-1 image.



Outlier detection (S-1) and DCNN (S-2) to detect changes between water areas so as to discriminate flooded areas from permanent water.

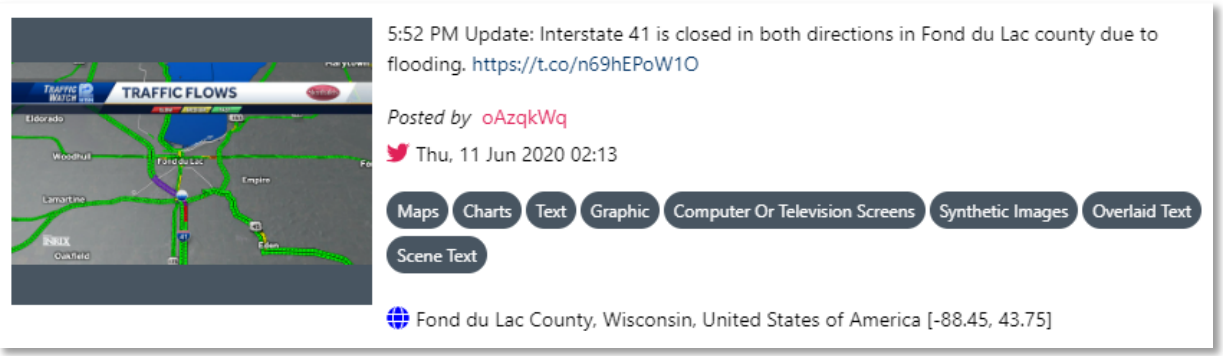
Outlier detection (S-1) to detect rice paddy cover changes, using pseudo-labelling for transferable supervised learning.

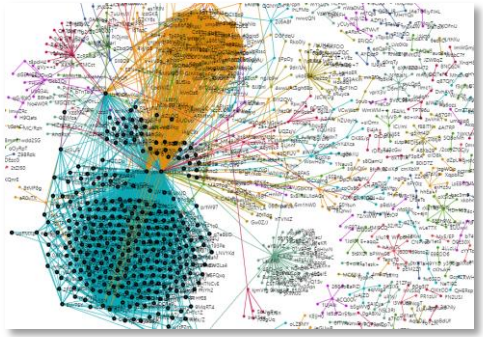
This allows for the accurate nation-wide depiction of rice paddy extent and consequently the large-scale monitoring of food security in South Korea.



Social media data use in all PUCs

- Real-time collection of Twitter posts based on keywords, location, and accounts
- Automatic geotagging of tweets in English, Italian, and Finnish
- Visual concepts extraction from Twitter images

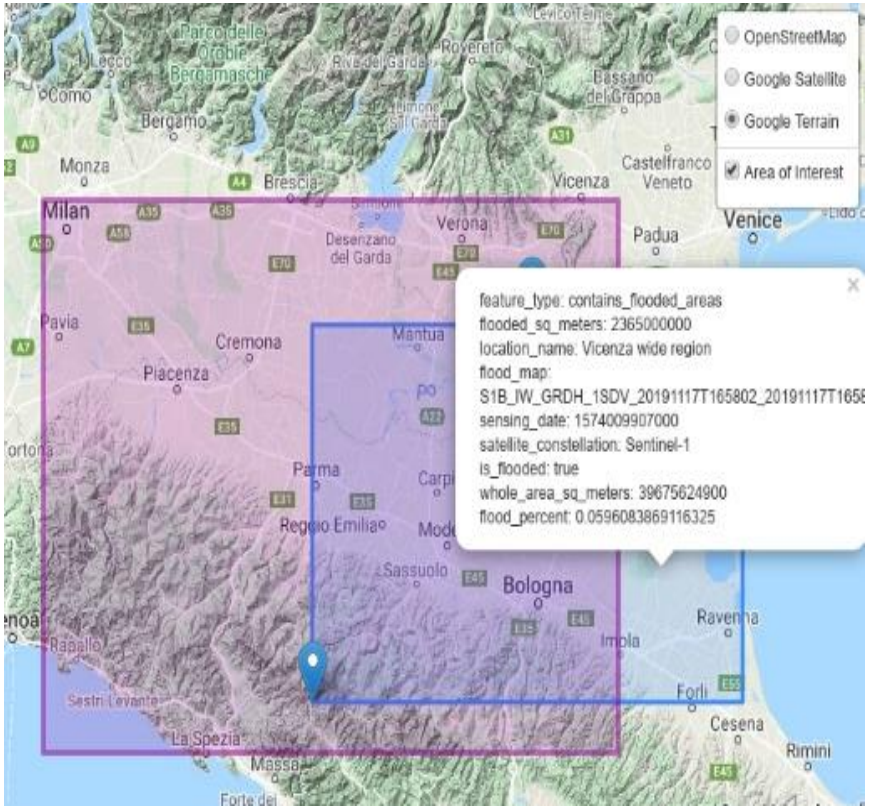




- Detection of trending topics on Twitter
- Identification of user communities and influential accounts
- Detection of events based on the rise of collected tweets

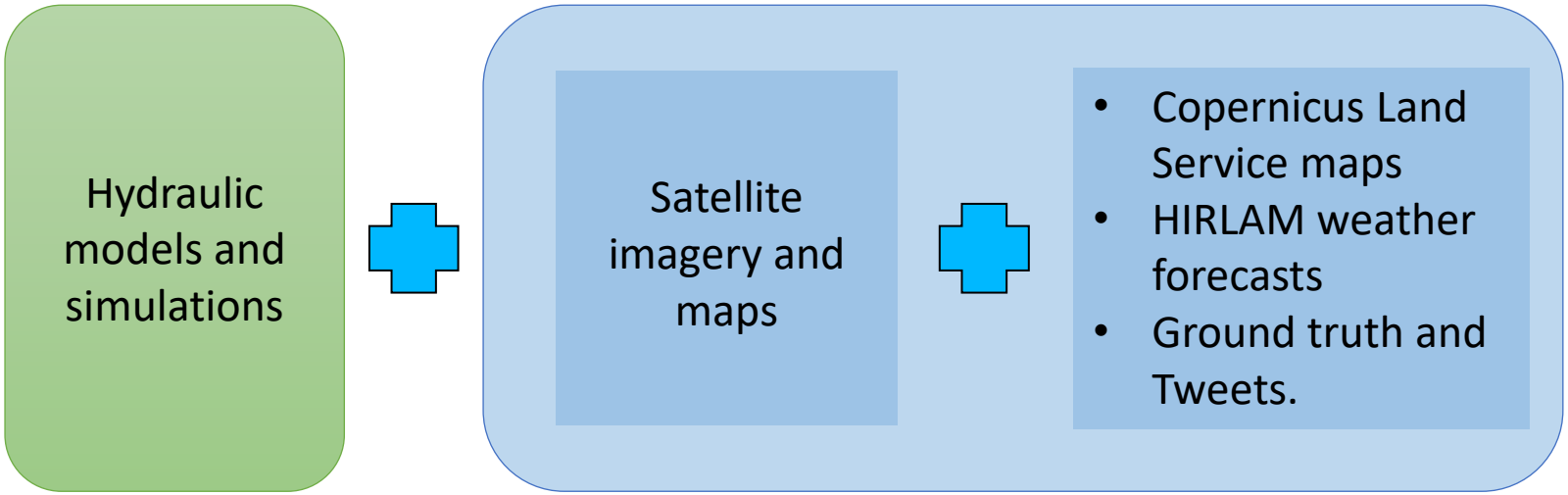
Combining EO and non-EO data in PUC1

- Detected floods and geotagged tweets are semantically represented in RDF
- Given an area and time of interest, geospatial semantic queries in GeoSPARQL can retrieve data of both types
- Results visualised on an interactive map



Pilot Use Case 1 (PUC1) - Flood Risk Assessment and Prevention

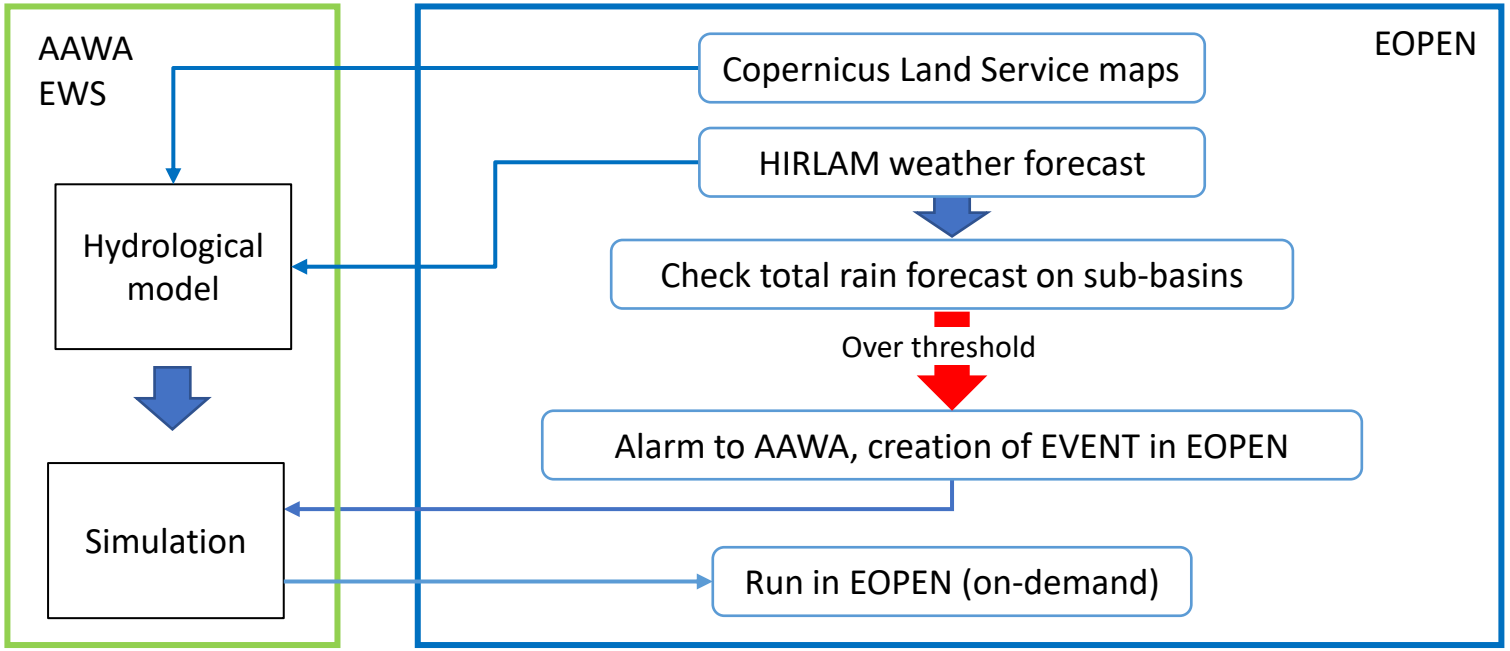
The EOPEN Platform for flood impact reduction



A distributed concept for flooded area delineation. With EOPEN service providers can merge the information provided by classic hydraulic models with satellite imagery and data from social media (Tweets) without the need to build their own ICT infrastructure.

PUC1: Hydrological model for flood prediction

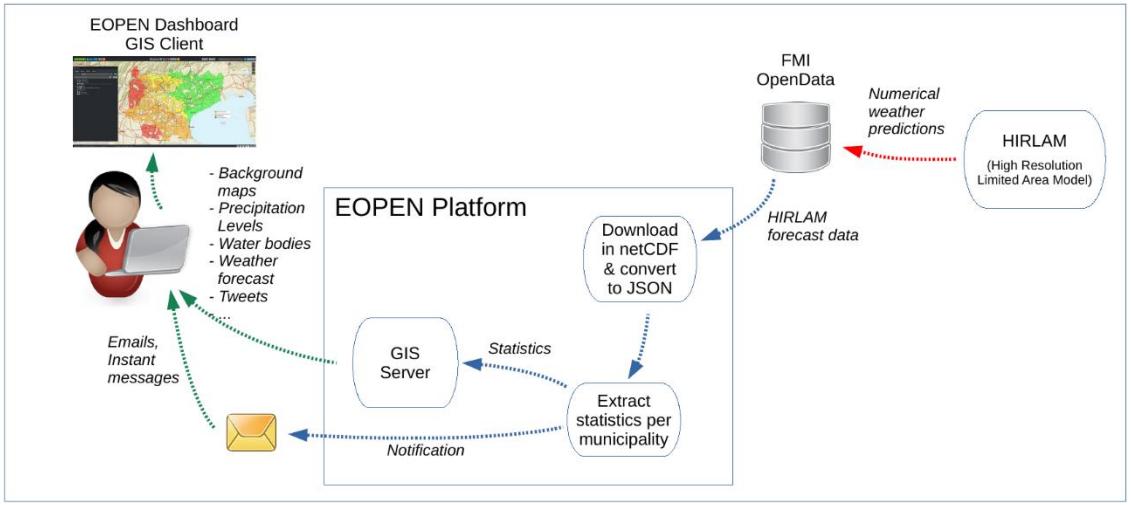
The EOPEN Platform for flood reduction



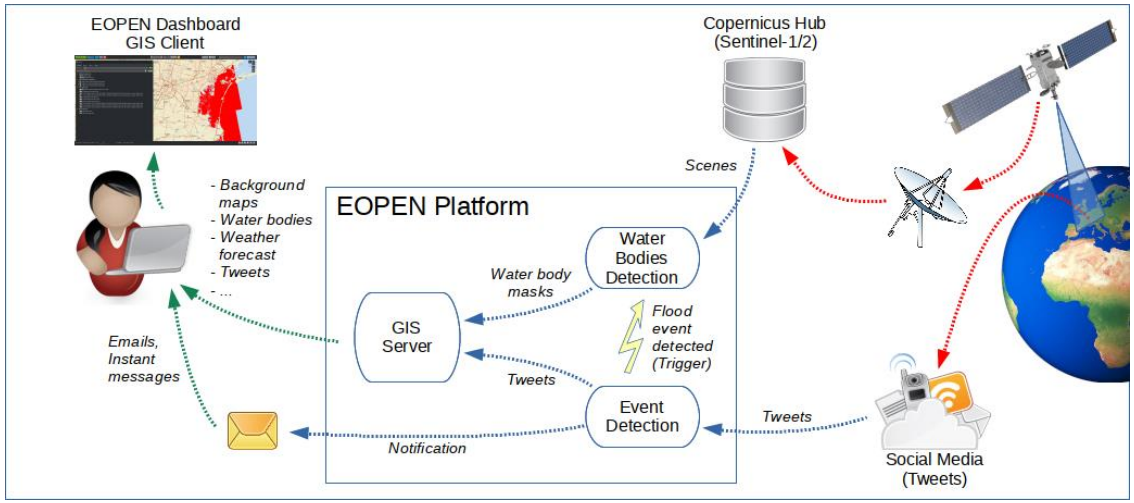
The EOPEN platform provides the opportunity to develop the concept of flooded area delineation. With EOPEN users can merge the information provided by classic hydraulic models with satellite imagine and data from social media inside a unique platform without the needs of a specific ICT infrastructure.

PUC1: The EOPEN Platform for flood reduction

Precipitation Levels Warning System



Flood Risk Assessment and Prevention



Pilot Use Case 2 (PUC2) - Food Security in South Korea

The problem

Overproduction of rice

- Large storage costs
- Underproduction of other major grains
- High dependence on imports

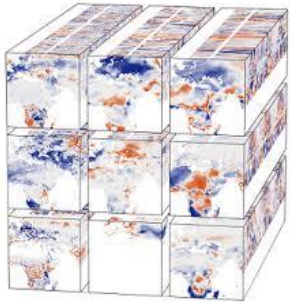
PUC2: EO-based Food Security Monitoring South Korea

Challenges

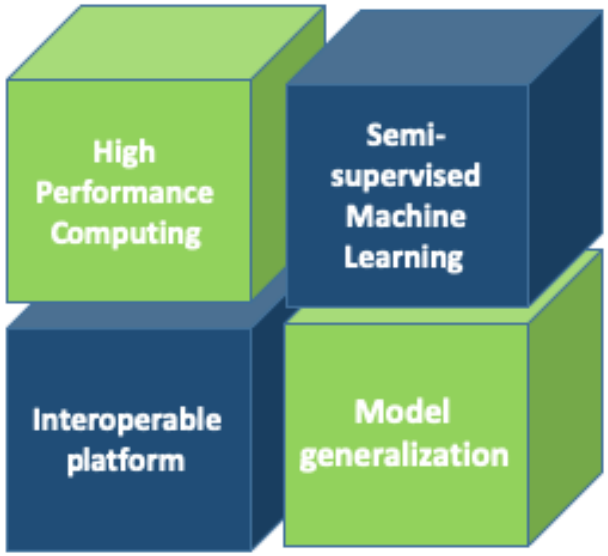
01 Interoperability
02 Exhaustiveness
03 Transferability
04 Scalability
05 Reliability

Requirements

- Big Data Management (TBs of data)
- Distributed processing
- Low dependence on ground truth information
- High generalization of machine learning modeling



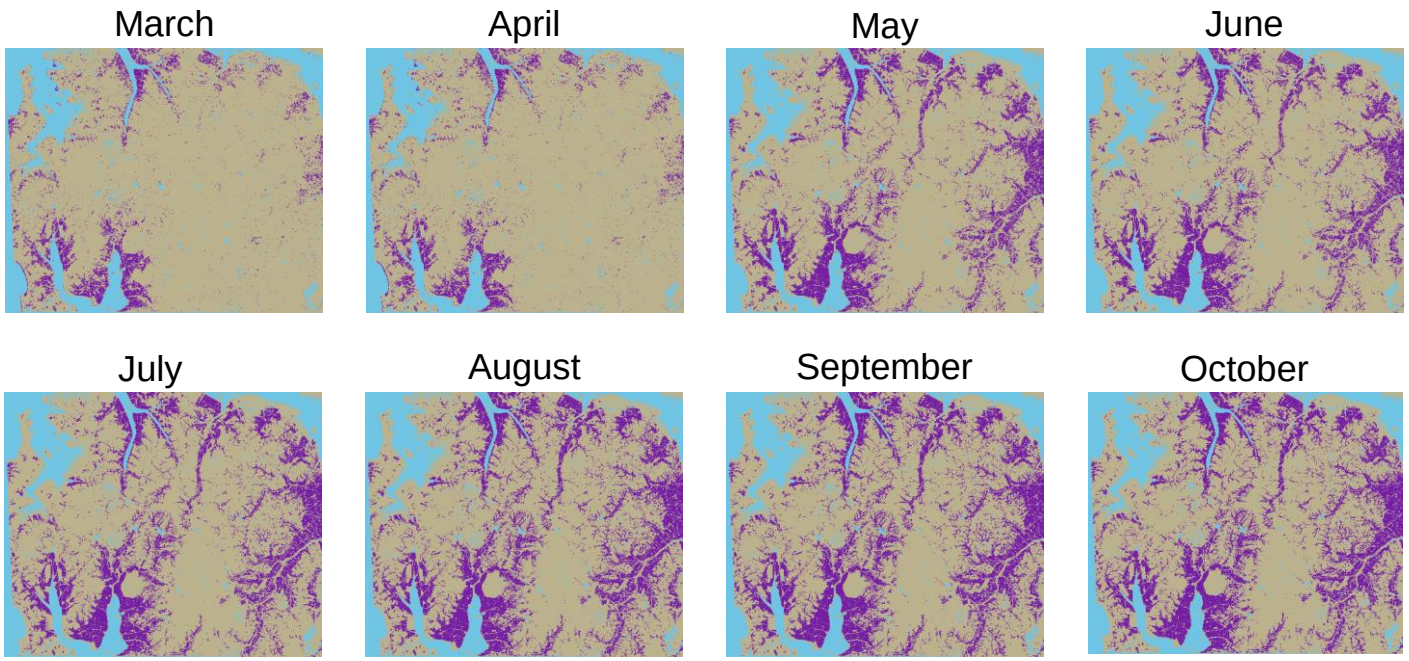
Solutions



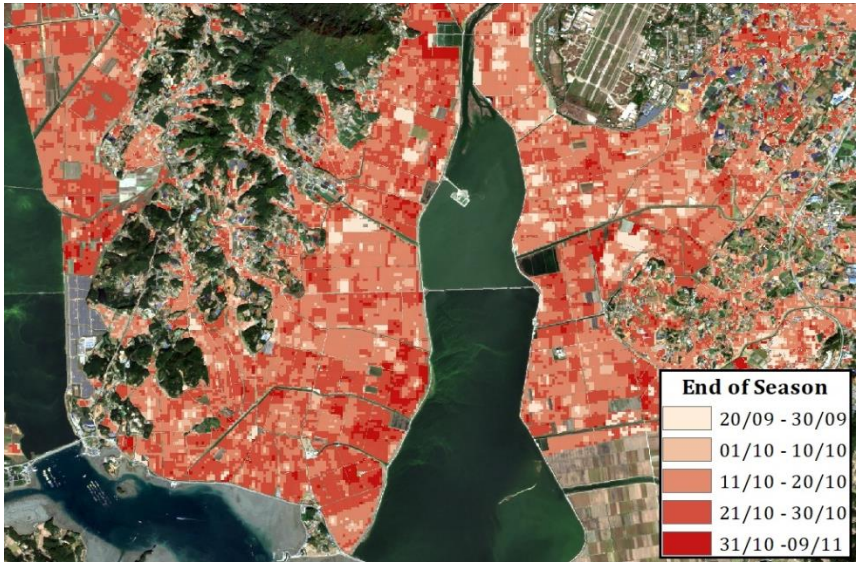
EO-based services

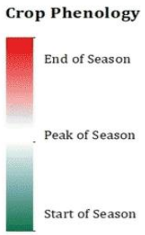
- Rice Paddy Mapping
- Rice Status Indicator
- Biomass and Yield Indicators

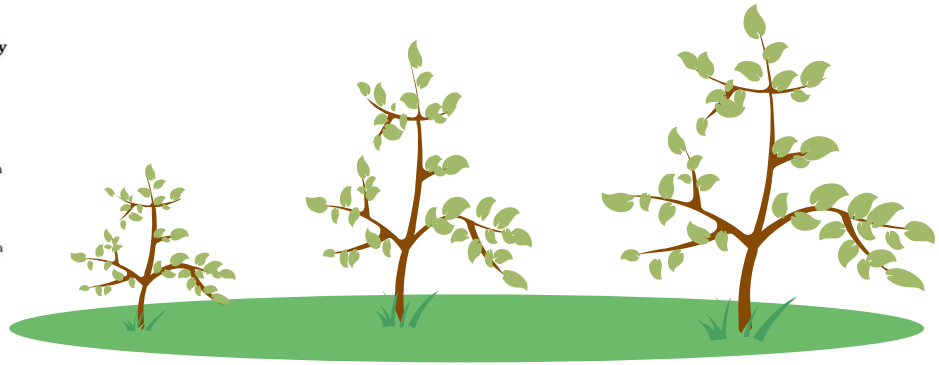
Rice Paddy Mapping



Rice Status, Biomass, Yield Indicators







Pilot Use Case 3 (PUC3) - Impact Arctic climate change in Finland

Stakeholder Challenges

Reindeer herders
- extra feeding due to ice under the snowpack
- molding problems in summers
- changes in reindeer pastures

Reindeer researchers
- long-term consequences for reindeer herding in Finland

Finnish Transportation and Infrastructure Agency
- increased road maintenance due to freezing/thawing
- insufficient monitoring of lower class roads

Stakeholder Requirements

- user-friendly interface
- easy access and management of data
- overlay satellite data over map
- user able to select areas of interest
- real-time visualization
- historical data browsing
- tools for statistical and time-series analysis
- future climate projections
- compare multi-platform data
- access to snow-related tweets

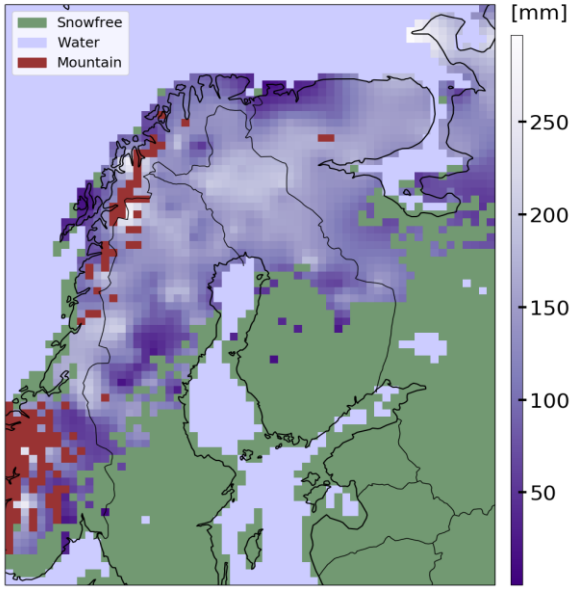
EOPEN Solution

Weather and climate data
- HIRLAM forecasts
- FMI ClimGrid
- FMI GlobSnow, SMOS Freeze/Thaw
- FMI OpenData: weather stations, climate projections
- Sentinel land-surface temperature

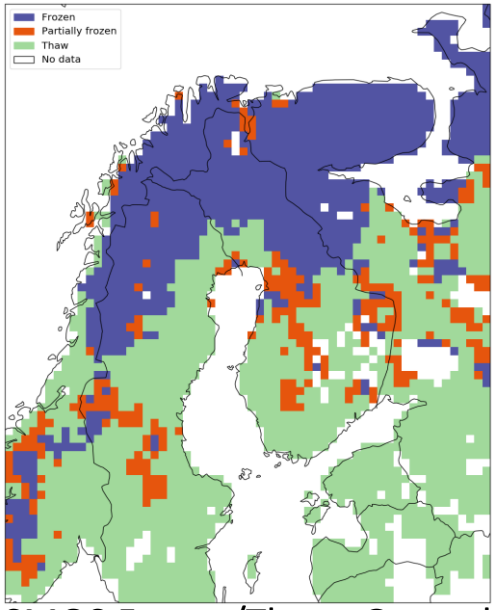
Infrastructure data
- reindeer herding areas
- administrative areas
- FTIA road maintenance classes

Visualization
- OpenSphere
- Dashboard
- Desktop apps (QGIS, ArcGIS, ...)

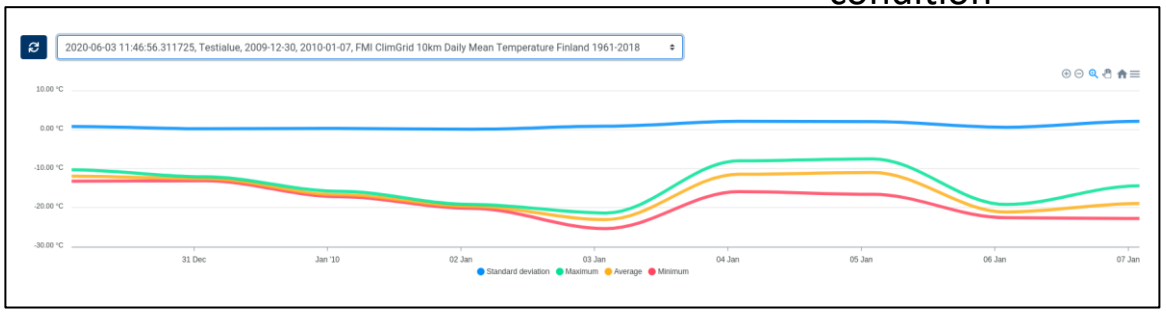
PUC3: Example data products and visualizations



GlobSnow: Snow



SMOS Freeze/Thaw: Ground condition



ClimGrid: Air temperature timeseries statistics

Gabriella.Scarpino@serco.com